



# GMOD: Managing Genomic Data from Emerging Model Organisms

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## Abstract

GMOD is a collection of interoperable open-source software components for managing, visualizing and annotating genomic data. GMOD components are used at hundreds of organizations, ranging from major model organism databases to individual labs. GMOD is well positioned to serve the converging interests of genomic model organism communities and evolutionary biology. In the past year there have been new releases of several core GMOD components, and a new wiki-based project website (<http://gmod.org>) has been launched.

## GMOD Community Resources

Start at GMOD.org

Downloads

FAQs & HOWTOs

Mailing Lists

Project Calendar

Contribute code! We're open source

GMOD for Biologists

Project Meetings

Project News

Help Desk: [help@gmod.org](mailto:help@gmod.org)

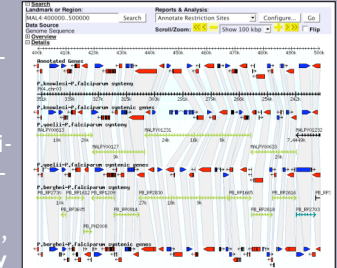
Contribute Doc! GMOD.org is a wiki

Most popular GMOD Components

<http://gmod.org>

## Comparative Genomics

GMOD supports visualizing comparative genomics data. Sybil shows syntenic regions and whole genome comparisons. CMap shows comparative maps of any type (genetic, physical, sequence, ...). SynView (shown), GBrowse\_syn and SynBrowse are GBrowse-based syntenic browsers.



## What can GMOD Do?

If you have	& you need to	then GMOD can help with
Genomic Sequence	View/search Annotate Organize	GBrowse Apollo, MAKER Chado Sequence Module
Comparative Genomics	View/search Annotate	CMap, SynView, Sybil, GBrowse_syn, SynBrowse Sybil
Phylogenies	Organize	Chado Phylogeny Module
Phenotype, Genotype	Organize Annotate	Chado Genetics Module Phenote
Microarray & Expression	View/search Organize	Java TreeView Chado Mage, Expression
Ontologies	Curate View	Chado CV module GO Term Viewer
Pathways	View, predict, organize	Pathway Tools
Publications	Curate/search Organize	TextPresso, PubSearch Chado Publication Module
Data!	Organize View/Query	Chado, BioMart, InterMine GMODWeb, BioMart, InterMine

## What's New in GMOD?

### New Components

MAKER is an annotation pipeline for eukaryotic genomes that produces GMOD compatible databases. MAKER identifies repeats, aligns ESTs and proteins to a genome and produces *ab initio* gene predictions.

The Community Annotation System (CAS) is a set of popular GMOD components prepackaged into a single system. It comes with GBrowse, Chado, Apollo, Modware, and MediaWiki with the TableEdit extension installed. CAS is under development.

Phenote is used to annotate biological phenotypes using ontologies, and pairs phenotypes with genotypes. Phenote-Chado integration is coming soon.

GBrowse\_syn is a GBrowse-based syntenic browser for displaying multiple genomes.

### New Features

GBrowse: automatic installation, rubberbanding, popup balloons, draggable and collapsible tracks, and track sharing.

Apollo: undo function, preferences editor, Chado adapter enhancements, and improved graph and GFF3 support.

CMap: ribbon and dot-plot displays, new feature glyphs, embeddable image generation, and directory guessing for easier installation.

Chado: ontology updates, materialized views, stock module, easier GFF loading and delete by GFF.

## Chado Database Schema

Chado is the unifying data model for GMOD. It is a modular and extensible database design for biological data. Chado supports sequence, genetic, phenotypic, ontology, gene expression and many other datatypes.

## Natural Diversity in GMOD

Chado has recently been extended with the Natural Diversity module, which supports stocks, individuals, pedigrees, crosses, geolocations, and phenotype and genotype experiments. Taxonomy and phylogenetic trees in Chado's core modules have also been rationalized.

Breed	Type	Father	Mother	Number of Eggs	Number of Adults
2	F2	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	0	0
4	F2	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	118	80
10	BC	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	119	70
11	BC	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	72	43
12	BC	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	0	0
13	BC	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	0	0
15	F1	Maltonius arcticus sp. Maltonius arcticus	Maltonius arcticus sp. Maltonius arcticus	0	0



## Who Uses GMOD?

AphidBase, ApiDB, ChromDB, CGD, DictyBase, FlyBase, Gramene, ParameciumDB, PlasmoDB, PossumBase, SGN, SmedGD, SpBase, VectorBase, wFleaBase, Xenbase, and hundreds of other large and small communities.



The GMOD Help Desk is hosted by NESCent and is funded by NIH grants to Ian Holmes at UC Berkeley and James Hu at Texas A&M.

<http://nescent.org>